

Incidence of Snakebite in Four Townships of Yangon Region

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The true incidence of snakebite in Myanmar is unknown. The current data are based on hospital returns to Ministry of Health and Sports and they are likely to be under-reported. A community-based survey is useful to know the current burden of snakebite and thus for planning and formulating strategies and specific interventions to combat snakebite related health problems in Myanmar. Thus, the present study was conducted in four townships of Yangon Region to determine the community incidence of snakebite before proceeding to nationwide population-based surveys. It was conducted in Dagon Myothit (East), Thongwa, Hlegu and Taikkyi townships by applying multi-stage cluster sampling in 2018. All males and females older than 5 years from the sampled households were eligible for the study. Respondents were interviewed using pretested questionnaire. The respondent had to answer for every member who spent the past one year in the selected household. Information was collected on 7,145 individuals from 2,018 households (70% from villages and 30% from urban wards). They included 47% males and 53% females with the mean age of 34.3 (18.6) years. Median family number was 4 and median family income was 200,000 kyats per month. There were 20 snakebites reported and two people died of snakebite. Annual incidence of snakebite and envenoming were 280 (95% CI: 176-424) and 168 (95% CI: 91-286) per 100,000 population respectively. Among the victims, there were 11 males (55%) and 9 females (45%) and their mean age was 34.4±11.9 years. Similar proportion of snakebite episodes happened in the morning, afternoon and during night times. Most of the bites occurred on the legs (90%). First aid treatment was practiced in 55% of patients and 45% applied tourniquets. After being bitten, 90% sought care from the formal health system as their first point of contact. This study informed a higher incidence of snakebite compared to health services data and to previous population-based surveys in Myanmar.

Keywords: Incidence of snakebite, Envenoming, Yangon Region, Myanmar

INTRODUCTION

Snakebite particularly in the rural tropics is a major cause of mortality and morbidity, and it has a significant impact on human health and economy through treatment-related expenditure and loss of productivity.¹ Snake bite is the single most important cause of envenoming worldwide and results in substantial mortality in many parts of Africa, Asia, and the Americas.² It is also endemic

in Myanmar with a total of 15,079 snakebite cases in 2014.³ Seventy percent of the bites are caused by Russell's vipers and mortality from snakebite is quite high (10%).⁴ In some townships of lower Myanmar (Ayeyawaddy Region), case fatality rates could be as high as 45% in severely envenomed cases.⁵

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DOI: <https://doi.org/10.34299/mhsrj.00986>

Snakebite is significantly neglected as a public health problem in the world as evidenced by the lack of available incidence data from most of the rural tropics where snake bites occur frequently. Chippaiux, *et al.* estimated that about 5 million cases of snakebites occur annually throughout the world leading to 125,000 deaths.⁶ White, *et al.* estimated more than three million bites per year resulting in more than 150,000 deaths. However, this data may be inaccurate because of the relative lack of information relating to snake bites and related deaths in rural tropics.⁷

The paucity of reliable data is partly related to inherent methodological difficulties, which include: poorly developed reporting and recording systems in countries with the highest burden, limitations in hospital-based data that can underestimate the problem^{8, 9} and seasonal and geographical variation in bite incidence.⁸⁻¹¹ Sound epidemiological data are, however, important to both give credence to the magnitude of the problem and raise awareness of snakebite as an important but neglected public health issue, and to assist prioritization of resources for prevention and treatment.

The true community incidence of snake bite in Myanmar is unknown. The current data are based almost exclusively on hospital returns to Ministry of Health and Sports and they are likely to be underreported. Previous research has shown that hospital data underestimate deaths due to snakebites by over 50%, and multiple hospital admissions at different levels of care can further distort hospital statistics.⁹

Although prevention and management strategies for snake bite have been done, the morbidity and mortality are increasing year by year. A population-based survey will be useful to know the current burden of snake bite, and thus for planning and formulating strategies and specific interventions to combat snake bite-related health problems in Myanmar. The most recent estimates of the global burden of snakebite also highlighted the need for good quality data on snakebite,

particularly from nationwide population-based studies.¹² The present study was conducted to assess the annual incidence and epidemiologic profile of snakebites in four townships of Yangon Region, one of the seven high incidence regions in Myanmar. It was a pilot study to determine the community incidence of snakebite before proceeding to nationwide population-based surveys in other parts of the country.

MATERIALS AND METHODS

A community-based cross-sectional survey was conducted in 4 townships of Yangon Region (2 townships with highest incidence and 2 townships with lowest incidence of snakebite) from March to June 2018. According to the hospital statistics (2016), Hlegu and Taikkyi townships were reported to have the highest incidence and Dagon Myothit (East) and Thongwa townships the lowest incidence of snakebites. These 4 townships were purposely selected in this study. Study population consisted of all males and females older than 5 years who resided in the sampled households for last one year.

Sample size and sampling

Sample size is calculated based on the estimated prevalence of snake bite (16.2 per 100,000 population) and 2016 incidence in Yangon of 10.2/100,000, assumed household size of 3.5. After getting sample size, power of the study is resulted as 0.9. In each study township, at least 10 clusters (ward/village) (7 villages and 3 wards chosen to get 70:30) were selected randomly. Then, 50 households were randomly selected from each cluster. Assuming that there would be about 3.5 persons in each household, total number of sample size would become 1750 in each township.

Data collection

Data was collected using a pre-tested questionnaire. The questionnaires were administered by primary health care workers, midwives and health assistants employed at health centers in the study townships. Data

collectors were trained by the research team before the field survey. For each household, an adult member was interviewed and he/she had to answer for every member who spent the past year in the selected household.

Information was collected on socio-demographics (age, sex, occupation, marital status, household income of respondents), snakebites (type of snake, site of bite, place and time of bite), their consequences (significant envenoming, death) and treatment seeking behavior. *Significant envenoming* was defined as the presence of local tissue necrosis at the site of bite, presence of neurotoxicity, nephrotoxicity or bleeding manifestations.

Data analysis

Data entry and analysis was performed in SPSS version 20 after checking for errors and inconsistencies. The incidence rates of snakebite, envenoming and death with 95% confidence intervals were calculated.

Ethical consideration

The study was approved by the Ethics Review Committee of University of Medicine 1, Yangon. Informed consents were taken from the participants after thorough explanation about the study.

RESULTS

The survey was conducted in 7 villages and 3 urban wards from each study township. One respondent from each of the 2018 households was interviewed. Information was collected on 7145 individuals from these 2018 households (70% from villages and 30% from urban wards). Their mean age (SD) was 34.3(18.6) years. Median household income was 200,000 kyats per month and median household member was 4. The background characteristics of the participants are shown in Table 1.

Snakebite incidence

Among 7145 individuals, 20 snakebites, 12 envenomings and 2 deaths were reported in the previous one year. Annual incidence

Table 1. Characteristics of the study respondents (n=7145)

Characteristics	Frequency (%)
Sex	
Male	3345(46.8)
Female	3799(53.2)
Age (years); mean SD	34.3(18.6)
Occupation	
Service (public/ private)	248(3.5)
Farmer	431(6.0)
Manual worker	1172(16.4)
Housewife	1925(27.0)
Student	1524(21.3)
Business	636(8.9)
Others	1205(16.9)

of snakebite, envenoming and mortality was 279.9(95% CI: 175.8-424.1), 167.9(95% CI: 90.9-285.6) and 27.9(95% CI: 4.8-92.4) per 100,000 population, respectively. Case fatality rate (CFR) was 10% in this study. Regarding the township-specific incidence, there were 314(95% CI: 127.2-652), 363.2 (95% CI: 147.2-753.5), 56.5 (95% CI: 3.09-278.8) and 386.1(95% CI: 169.3-761.9) snakebites per 100,000 population in Dagon Myothit (East), Thongwa, Hlegu and Taikkyi townships, respectively.

Profile of snakebite victims

Among the 20 victims (6 each from Dagon Myothit (East) and Thongwa, 1 from Hlegu and 7 from Taikkyi township), there were 11 males (55%) and 9 females (45%) and their mean age was 34.4±11.9 years. Types of snake recalled by the respondents were Russell's viper (6/20), sea snake (4/20), cobra (2/20) and Mwe-Pa-Dote (1/20). Respondents did not know the type of snake in 7/20 cases.

Site of bite, occupation of the victims, time of bite and place of bite are shown in Table 2. As expected, the majority of snake bites occurred on the legs and feet (90%) followed by the hand (10%). Farmers made up the highest category of snake bite victims (30%) with the smallest percentage occurring in students (0.5%). Similar proportion of snake bite episodes happened in the morning, afternoon and during night times which are close to a third in each category.

Table 2. Distribution of 20 snakebites (percent) by occupation, time and place of bite, and site of bite

Characteristics	Frequency (%)
<i>Occupation</i>	
Manual worker	3(15)
Farmer	6(30)
Housewife	3(15)
Business	3(15)
Student	1(5)
Others	4(20)
<i>Time of bite</i>	
Morning	7(35)
Evening	6(30)
Night times	7(35)
<i>Place of bite</i>	
Road-side	6(30)
Field	5(25)
Inside home	5(25)
Home premises	3(15)
Water	1(5)
<i>Site of bite</i>	
Lower limb	18(90)
Upper limb	2(10)

Table 3. First-aid treatment and treatment seeking behavior among 20 snakebite victims

Characteristics	Frequency (%)
<i>First-aid treatment</i>	
Bandaging with cloth padding	1(5)
Tourniquet application	9(45)
Immobilization	1(5)
None	9(45)
<i>Treatment seeking behavior</i>	
Hospital	16(80)
Rural Health Centre	1(5)
Urban Health Centre	1(5)
Local healer	1(5)
Home	1(5)

First-aid treatment was practiced in 11/20 patients (55%) and majority were applied tourniquets (9/20, 45%). After being bitten, 16 patients (80%) were sent to the hospital, one patient (5%) to the Rural Health Centre and one patient (5%) to Urban Health Centre (Table 3).

DISCUSSION

The present survey conducted in four townships of Yangon Region discovered an incidence of snakebite as 280/100,000. It was higher than those reported in previous population-based surveys in Myanmar. The most recent survey in 2015 reported an incidence of snakebite 116/100,000 in two

high incidence areas of Mandalay Region.¹³ A study in 2005 in two other townships of Mandalay and Magway regions of central Myanmar reported similarly high annual incidence as high as 100/100,000 in Kyauka-padaung and 115/100000 in Taungdwingyi Township.¹⁴ In fact, these regions (Yangon, Mandalay and Magway) are among the seven high incidence regions of Myanmar, where 90% of snakebites occur and where 23 millions people live.

Myanmar is in a region having one of the highest snakebites incidences in the world. Kasturiratne, *et al.* reported that South and South East Asia suffer about 232,000 envenomings every year.¹² A survey in Bangladesh reported an incidence of 623/100,000¹⁰ and a national survey in Sri Lanka reported an incidence of 398/100000.¹⁵

Study finding on incidence of snakebite is much higher than the 2016 national incidence (17.5/100,000), 2016 incidence in Yangon Region (10.2/100,000) as reported in the public health statistics¹⁶ and an incidence of 127/100,000 rural populations of Yangon Region in 2014 calculated using the HMIS data (Ministry of Health and Sports) and Myanmar Population and Housing Census.^{3,17}

Health services data generally underestimate the incidence. The reasons why relatively less snakebites were recorded in the health services data may include failure of some victims to seek health care, or seeking care from traditional healers only, and deaths of some victims before they could seek medical care. A proportion of snakebites cause no symptoms of envenoming: because the venomous snake injects no venom (dry bites), because some bites are by non-venomous snakes or other animals. These victims may decide not to seek medical care because they develop no symptoms.

The quality of the incidence data depended upon memory of an event and is therefore subject to recall bias. However, the main outcome of interest, a snakebite, is highly memorable and is greatly feared as it is life threatening. Using HMIS data and Myanmar

census data (2014), calculated incidence in rural areas Yangon Region was highest (127/100,000) compared to those in Mandalay (69/100,000) and Magway Regions (62/100,000). This suggests that the information provided by the respondents was affected little by recall bias. Thus, the incidence identified by the present survey is close to the true incidence in the study area.

The case fatality rate of snakebite in Yangon Region was 10%. It was 5.4% in Mandalay Region and as high as 19% in Magway Region as reported in previous population-based surveys.^{13, 14} The case fatality rate for the whole country based on health services data (HMIS, MOH 2014) was 4.2%.

In this study, slight male preponderance was observed among the victims, a finding which is consistent with other studies although male to female ratio varied.^{18, 19} Snakebite is an occupational hazard for farmers (30%) and it may explain why males are more affected. The study confirms the earlier observations that legs (90%) and upper limb (10%) are common sites of bite.^{10, 14, 18}

First aid treatment was carried out in 55% the victims. Applying tourniquet is still widely practiced (45%) among the victims despite its ill effects. Correct practice of bandage with cloth padding or immobilization was done in only 10%. The study highlights that health education activities need to be strengthened on first aid treatment of snakebites in rural areas.

Antivenom is mainstay in management of snakebite. It has been shown that early administration of adequate dose of anti-venom soon after the bite carries a better prognosis and less complication.²⁰ It is encouraging that 90% of the victims in this study went directly to hospital or rural health centre. In Mandalay study, 87.7% sought care from the formal health system as their first point of contact.¹³ With only 20 snakebite victims, it is suggested that a hospital-based study should be conducted to further understand the health services use and health outcomes in a large number of patients.

Envenoming was observed in 60% of snakebite cases in this study. Considering difficulties in getting such clinical information through community survey, there is a possibility that incidence of envenoming might be increased or decreased due to recall bias.

This study informed a higher incidence of snakebite than recorded in health services data. This has implications for service planning and formulating strategies and specific interventions to combat snakebite-related health problems in Myanmar.

As a further recommendation, it is suggested to conduct the similar studies in various selected townships in states and regions all over Myanmar to achieve the representative country figures of actual snakebite incidences.

Competing interests

The authors declare that they have no competing interests.

ACKNOWLEDGEMENT

This study was supported by DMR External Grant (2017-18). The authors would like to thank Township Medical Officers and Basic Health Staffs from Dagon Myothit (East), Thongwa, Hlegu and Taikkyi townships for their kind help and support to conduct this study. Last but not the least, we are grateful to all study participants.

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